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03/29/2004

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EXAMINER

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.



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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/812,113  
Filing Date: March 29, 2004  
Appellant(s): LI ET AL.

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Lowell L. Carson  
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For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed 12/27/07 appealing from the Office action mailed 4/6/07.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

**NEW GROUND(S) OF REJECTION**

Claims 1, 5, 7-14, 17-20, 22-23, 25-29 & 32-34 are rejected under 35 USC 103(a) as being unpatentable over Liu et al. (USPN 6,433,303) in view of Nakatani et al. (USPN 5,811,754), Liu et al. (USPN 6,433,305) and Smith (USPN 5,296,673).

Claims 6 & 16 are rejected under 35 USC 103(a) as being unpatentable over Liu et al. (USPN 6,433,303) in view of Nakatani et al. (USPN 5,811,754), Liu et al. (USPN 6,433,305), Smith (USPN 5,296,673) and Noddin (USPN 5,973,290).

#### **(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

#### **(8) Evidence Relied Upon**

6,433,303	Liu et al.	08-2002
5,811,754	Nakatani et al.	09-1998
6,433,305	Liu et al.	08-2002
5,296,673	Smith	03-1994
5,973,290	Noddin	10-1999

#### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 5, 7-14, 17-20, 22-23, 25-29 & 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (USPN 6,433,303) in view of Nakatani et al. (USPN 5,811,754), Liu et al. (USPN 6,433,305) and Smith (USPN 5,296,673).

Liu et al. ('303) discloses an apparatus and method for forming an array of microcavity holes using a laser. An optical mask divides the beam into multiple beams (sub-beams) and a lens system focuses them. The device generates multiple beams of one diameter, which are then magnified (by a factor less than one) to produce multiple beams having a diameter less than the first diameter. A diffractive optical element (DOE) may be used in place of the optical mask. Femtosecond laser pulses may be used. The imaging of the mask onto the workpiece requires the use of a two-lens system. The mask is placed in the focal plane of the lens 122 and the workpiece is placed in the focal plane of another lens 126. Using this lens system the image magnification ratio is given by the ratio of the focal length of the two lenses, that is,  $M=f_2/f_1$ . The workpiece is mounted onto an XYZ translation stage. The turning mirror 124 before the objective lens allows a microscope imaging set up including a CCD camera imaging lens 138 and CCD camera 140 to monitor the drilling in real time. The system may include a turning mirror mounted on a motor. The system forms a laser light pattern on the workpiece, which is substantially the same as the apertures in the mask 120 but magnified in its linear dimensions by a factor of M. A diffractive optical element (DOE) and a telecentric lens may be used in place of the mask. A DOE with a focusing lens can generate a desired pattern on the surface of the workpiece.

Although Liu et al. ('303) teaches the translation of the workpiece stage in order to form an array of microcavities on the workpiece; motion of the mask is not taught.

Nakatani et al. discloses an apparatus for machining a workpiece to form holes (vias) using a laser. Imaging magnification is automatically adjusted to a predetermined value. The apparatus includes a light source system, mask (3) (having a predetermined pattern), an imaging lens (for copying a pattern image of the mask onto the workpiece), a mask moving mechanism (4) for moving the mask in a direction perpendicular to an optical axis (L) of the imaging lens (5), a workpiece moving mechanism for moving the workpiece in a direction perpendicular to the optical axis of the imaging lens.

It would have been obvious to one of ordinary skill in the art at the time of the invention to move the mask as taught by Nakatani et al. in the Liu et al. ('303) apparatus because the greater mobility would improve the circularity of the exit holes and reduce the taper of the holes. (Liu et al. '303 col. 6, lines 15-16).

Liu et al. ('303) does not teach pitch or demagnification.

Liu et al. ('305) discloses an apparatus and method of laser machining using an ultra fast laser. A plurality of holes with a pitch less than the wavelength of the laser are drilled into the workpiece. A femtosecond laser is used with 750 nm. Holes diameters may be 500 nm or 750nm. Holes may be of a sub-wavelength pitch.

It would have been obvious to one of ordinary skill in the art at the time of the invention to determine and use the pitch as taught by Liu et al. ('305) in the Liu et al. ('303) system because it fulfills the objective of micromachining, that is, formation of microcavities.

Smith discloses laser machining in which a target is ablated (drilled) in order to form holes. The UV light passes through a mask into a telecentric lens system, which projects a reduced size image of the mask onto the workpiece. The beam may be scanned, preferably by deflection using a mirror, which is moved linearly to translate the laser beam across the surface of the mask. The mask and target may be adjusted with each other, that is, there is movement of the mask. A linear demagnification of 5:1 is achieved with a minimum number of optical elements in order to maximize the proportion of the laser light transmitted to the workpiece. Linear demagnification of 5:1 from the mask through the lenses to the on-target image of the mask is preferred for ablating the apertures in those laminates although other demagnifications could be used for example ranging from 1:1 to 10:1. Resolution of 1 to 10 micrometers, preferably about 2 micrometers and distortion of only 1 to 30, preferably about 2 micrometers at full image field are preferred. The workpiece is moved using an XYZ plane. This allows the patterns to be step and repeated.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use demagnification as taught by Smith in the Liu et al. ('303) system because the fine structures which may be formed on the workpiece.

Claims 6 & 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('303), Nakatani et al., Liu et al. ('305) and Smith, as stated in the above and further in view of Noddin (USPN 5,973,290).

Liu et al. ('303), Nakatani et al., Liu et al. ('305) and Smith does not teach the use of harmonic crystal.

Noddin discloses a laser drilling system in which the laser beam is formed using a lithium triborate crystal for harmonic generation. (abstract)

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a crystal for harmonic generation and thus laser beam generation, as taught by Noddin in the Liu et al. ('303), Liu et al. ('305) and Smith system because it is merely a part of the laser generation system.

#### **(10) Response to Argument**

***1. Claims 1, 5, 7-14, 17-20, 22-23, 25-29 & 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (USPN 6,433,303) in view of Nakatani et al. (USPN 5,811,754), Liu et al. (USPN 6,433,305) and Smith (USPN 5,296,673).***

Applicant argues that Liu et al. ('303), Liu et al. ('305) and Smith do not disclose, singly or in combination, teach a means for translating an array of sub-beams in a direction perpendicular to the optical path. The examiner respectfully disagrees because Liu et al. ('303) does teach the formation of an array of sub-beams and workpiece is mounted on to a translation stage. Figure 2 shows that the mask and the stage are perpendicular to the optical axis. There is motion albeit the motion of the stage and not the mask directly. The new grounds of rejection have included another reference



Nakatani et al. which discloses that the workpiece, the mask or the two in combination may be translated (perpendicular to the optical axis).

Applicant argues that the examiner's statement; "the mask and target may be adjusted with each other, that is, there is movement of the mask" is a characterization of Smith. The examiner respectfully disagrees because the above statement is an explanation of the apparatus movement in Liu et al. ('303) the primary reference. Motion of the stage or motion of the mask would yield the same result with respect to the drilling of the vias (microcavities). Because of the misunderstanding of relative motion, another reference Nakatani et al. has been added to the rejection for applicant's benefit. Smith was used to teach demagnification.

Applicant argues that Liu et al. ('305) does not teach a mask or a DOE, an array of sub-beams or the motion of the sub-beams perpendicular to the optical path. The examiner respectfully notes that Liu et al. ('305) is used to teach the pitch of the drilled holes. Liu et al. ('303), the primary reference teaches, a mask or a DOE, an array of sub-beams, and observation of figure 2 reveals that the motion of the stage would render the sub-beam motion perpendicular to the optical path by means of relative motion. Again in order to clarify the relative motion issue, Nakatani et al. (new reference) has been used to disclose that the workpiece, the mask or the two in combination may be translated (perpendicular to the optical axis).

Applicant argues that Liu ('305) does not disclose the use of a mask, DOE, or array of sub-beams and therefore cannot be used for a means of translation and so forth. In response to applicant's arguments against the references individually, one

cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant argues that Smith discloses a mask to form an array of sub-beams but does not disclose translating the image formed by the mask in a direction perpendicular to the optical path. The examiner respectfully notes that instant claims state that the image mask is moved. Furthermore, Smith was used to teach demagnification. Liu et al. ('303) the primary reference teaches an array of sub-beams and the translation of the workpiece stage resulting in a relative "translation motion" of the mask. Because of the misunderstanding of relative motion, another reference Nakatani et al. has been added to the rejection for applicant's benefit.

**2. Claims 6 & 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('303), Nakatani et al., Liu et al. ('305) and Smith, as stated in the above and further in view of Noddin (USPN 5,973,290).**

Applicant argues that Noddin does not teach translation deficiencies. The examiner respectfully notes that Noddin was used to disclose a laser drilling system in which the laser beam is formed using a lithium triborate crystal for harmonic generation. As stated above, Liu et al. ('303) does teach translation motion which is perpendicular to the laser beam, albeit by motion of the stage. Nakatani et al. discloses that the

workpiece, the mask or the two in combination may be translated (perpendicular to the optical axis).

Applicant argues that Noddin et al. uses a single beam and thus cannot teach an array of sub-beams. The examiner respectfully notes that Noddin et al. teaches the use of a harmonic generating crystal and Liu et al. ('303) teaches an array of sub-beams.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

This examiner's answer contains a new ground of rejection set forth in section **(9)** above. Accordingly, appellant must within **TWO MONTHS** from the date of this answer exercise one of the following two options to avoid *sua sponte* **dismissal of the appeal** as to the claims subject to the new ground of rejection:

(1) **Reopen prosecution.** Request that prosecution be reopened before the primary examiner by filing a reply under 37 CFR 1.111 with or without amendment, affidavit or other evidence. Any amendment, affidavit or other evidence must be relevant to the new grounds of rejection. A request that complies with 37 CFR 41.39(b)(1) will be entered and considered. Any request that prosecution be reopened will be treated as a request to withdraw the appeal.

(2) **Maintain appeal.** Request that the appeal be maintained by filing a reply brief as set forth in 37 CFR 41.41. Such a reply brief must address each new ground of rejection as set forth in 37 CFR 41.37(c)(1)(vii) and should be in compliance with the other requirements of 37 CFR 41.37(c). If a reply brief filed pursuant to 37 CFR 41.39(b)(2) is accompanied by any amendment, affidavit or other evidence, it shall be treated as a request that prosecution be reopened before the primary examiner under 37 CFR 41.39(b)(1).

Extensions of time under 37 CFR 1.136(a) are not applicable to the TWO MONTH time period set forth above. See 37 CFR 1.136(b) for extensions of time to reply for patent applications and 37 CFR 1.550(c) for extensions of time to reply for ex parte reexamination proceedings.

Respectfully submitted,

/M. Alexandra Elve/

Primary Examiner, Art Unit 1793

Conferees

/Jerry A Lorengo/  
Supervisory Patent Examiner, Art Unit 1793

/Gregory L Mills/  
Supervisory Patent Examiner, Art Unit 1700

**A Technology Center Director or designee must personally approve the new ground(s) of rejection set forth in section (9) above by signing below:**

/Gregory L Mills/  
Supervisory Patent Examiner, Art Unit 1700, Director's designee

Application/Control Number: 10/812,113  
Art Unit: 1700

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